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The precision frontier: hunting for new short-range forces with resonant sensors[1]

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We normally think of large accelerators and large-scale cosmic events when we consider the frontiers of elementary particle physics, pushing to understand the universe at higher and higher energy scales. However, several tabletop low-energy experiments are posed to discover a wide range of new physics beyond the Standard model, where feeble interactions require precision measurements rather than high energies. In our experiments, high-Q resonant sensors enable ultra-sensitive force and field detection. In this talk I will describe two applications of these sensors in searches for new physics, based on techniques in atomic-molecular-and optical (AMO) physics. First, I will discuss an experiment which uses laser-cooled optically trapped silica nanospheres to search for corrections to Newtonian gravity at micron distances with zeptonewton sensitivity. Second, I will discuss the status of the Axion Resonant InterAction Detection Experiment (ARIADNE), a new precision magnetometry experiment designed to search for a notable dark-matter candidate: the QCD axion.

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